Legislative Analyst's Office
Supplemental Report of the 2007 Budget Act
2007-08 Fiscal Year

Item 3640-301-6051– Wildlife Conservation Board / Department of Fish and Game

1. ***Wildlife Conservation Board (WCB) Vegetation Mapping. The Department of Fish and Game and WCB shall report to the Legislature (including the budget and fiscal committees of both houses) on or before January 10, 2008, on the following:***
   (a) By acre and location, how much vegetation mapping is planned to be conducted in 2007-08.
   (b) A map of general geographic areas that the Department and WCB feel is priority locations to conduct vegetation mapping.
   (c) A map of the known wildlife corridors in the state, based on existing data available to the Department and WCB.

DEPARTMENT RESPONSE:

FY 2007-08 – Vegetation Classification and Mapping Program

Program Summary

The Department of Fish and Game's (Department) Vegetation Classification and Mapping Program (VegCAMP) facilitates and oversees efforts to develop accurate and scientifically defensible maps and classifications of vegetation and/or habitat throughout the state. It does this to support conservation and management decisions at the local, regional, and state level. Virtually all such efforts require a map and concomitant classification of vegetation and habitats to help drive planning and long-range management processes. VegCAMP works with many branches of local and state-wide agencies and organizations involved with such efforts to help ensure the best, most effective methods to accomplish such work (for example, see link to the vegetation MOU committee at http://ceres.ca.gov/biodiversity/vegmou.html).

The Department's VegCAMP program is a relatively new one, formed in the spring of 2003 and has evolved from previous programs within the Biogeographic Data Branch (BDB) including the Natural Communities program within the California Natural Diversity Database and the Significant Natural Areas Program. VegCAMP is a synthesis of these two previous programs that enables more focused effort on developing and maintaining the maps and classification of all vegetation and habitats in the state. The staff in the VegCAMP Unit are professional ecologists with training in landscape, vegetation, plant, and animal ecology.

The principal roles of the VegCAMP program include:

a) Developing and maintaining a standardized vegetation classification system for California.
b) Developing best methods of vegetation assessment including sampling, analyzing, reporting, and mapping vegetation at multiple scales.
c) Training resource professionals on these techniques and coordinating with other agencies and organizations to ensure a statewide, standardized approach toward collecting, reporting, and interpreting vegetation data.
d) Developing best practices for using these data for long-range conservation and management of natural lands in the state.
e) Conducting integrated vegetation assessments throughout the state in areas with high conservation and management interest to the Department and other agencies.
f) Archiving and distributing quality vegetation data to all who need it.
g) Coordinating with other state, federal, and local agencies and organizations involved in vegetation assessment.
h) Integrating vegetation assessment with single species and habitat assessment for unified conservation assessments.

Long-range goals of the program include:

a) Completing and maintaining a state-wide vegetation map and classification in collaboration with other agencies and organizations.
b) Developing the most appropriate vegetation products for conservation planning and natural resources management within the state.
c) Integrating the program with similar ones from other states and countries to facilitate national and international conservation and management of natural resources.

(See Figure A for a map of projects completed to date.)

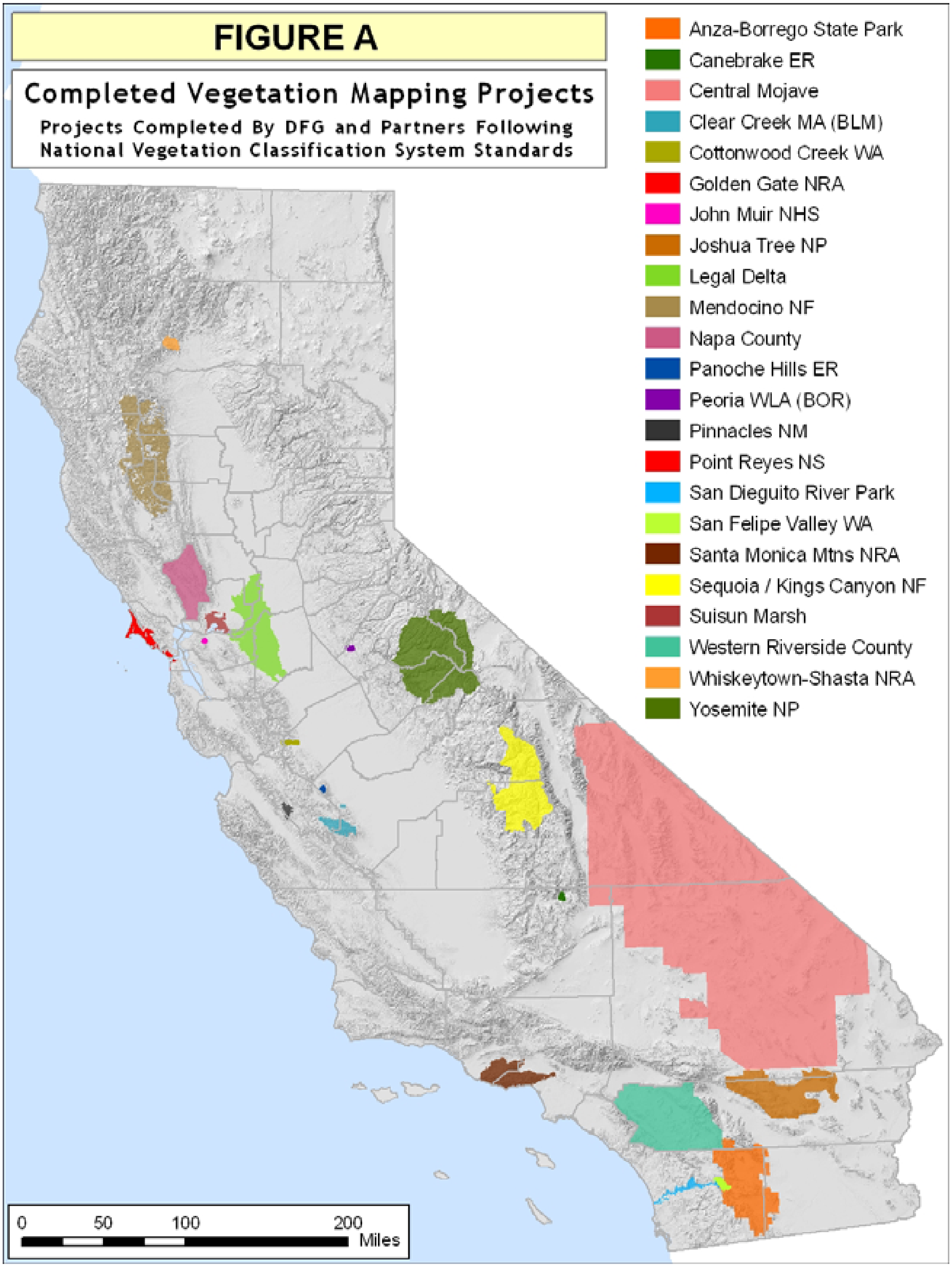


FIGURE A
Completed Vegetation Mapping Projects
Projects Completed By DFG and Partners Following National Vegetation Classification System Standards
Anza-Borrego State Park
Canebrake ER
Central Mojave
Clear Creek MA (BLM)
Cottonwood Creek WA
Golden Gate NRA
John Muir NHS
Joshua Tree NP
Legal Delta
Mendocino NF
Napa County
Panoche Hills ER
Peoria WLA (BOR)
Pinnacles NM
Point Reyes NS
San Dieguito River Park
San Felipe Valley WA
Santa Monica Mtns NRA
Sequoia / Kings Canyon NF
Suisun Marsh
Western Riverside County
Whiskeytown-Shasta NRA
Yosemite NP
0
50
100
200
Miles

a) **By acre and location, how much vegetation mapping is planned to be conducted in 2007-08.**

Completion of the Northern Sierra Nevada vegetation classification and mapping Project –

The first part of this project, the development of a vegetation classification of the northern Foothills, was funded by the Resources Assessment Program for $395,500 in 2004. The project area encompasses 2.56 million acres. The classification was finalized in the spring of 2007, the mapping project will start as soon as contracting allows. Mapping will be completed within 10 to 18 months. WCB is providing approximately $3.9 million of Proposition 84 funding, through a grant to the Department, to complete this project. The Department is providing the match through in-kind services of $1.5 million from existing salaries of permanent staff dedicated to the project, over the period of the grant. In addition, the Sierra Nature Conservancy has committed $300,000 annually from their operating budget for the current year and next, through a contract agreement with the Department.

A detailed vegetation map of the Northern Sierra Nevada Foothills will serve as a surrogate for wildlife and plant habitat for many species, and when combined with species and community level wildlife and plant inventory information could serve as the baseline for habitat quality and quantity monitoring. Such a map is critical for sound regional planning. Several wildlife areas and jointly-managed areas (including Tehama, North Table Mountain, Dye Creek, Daugherty Hill, Spenceville, and Pine Hill) are within the northern Foothills project area, and would also benefit from detailed mapping.

(Figure B – Northern Sierra Project Area map on next page).

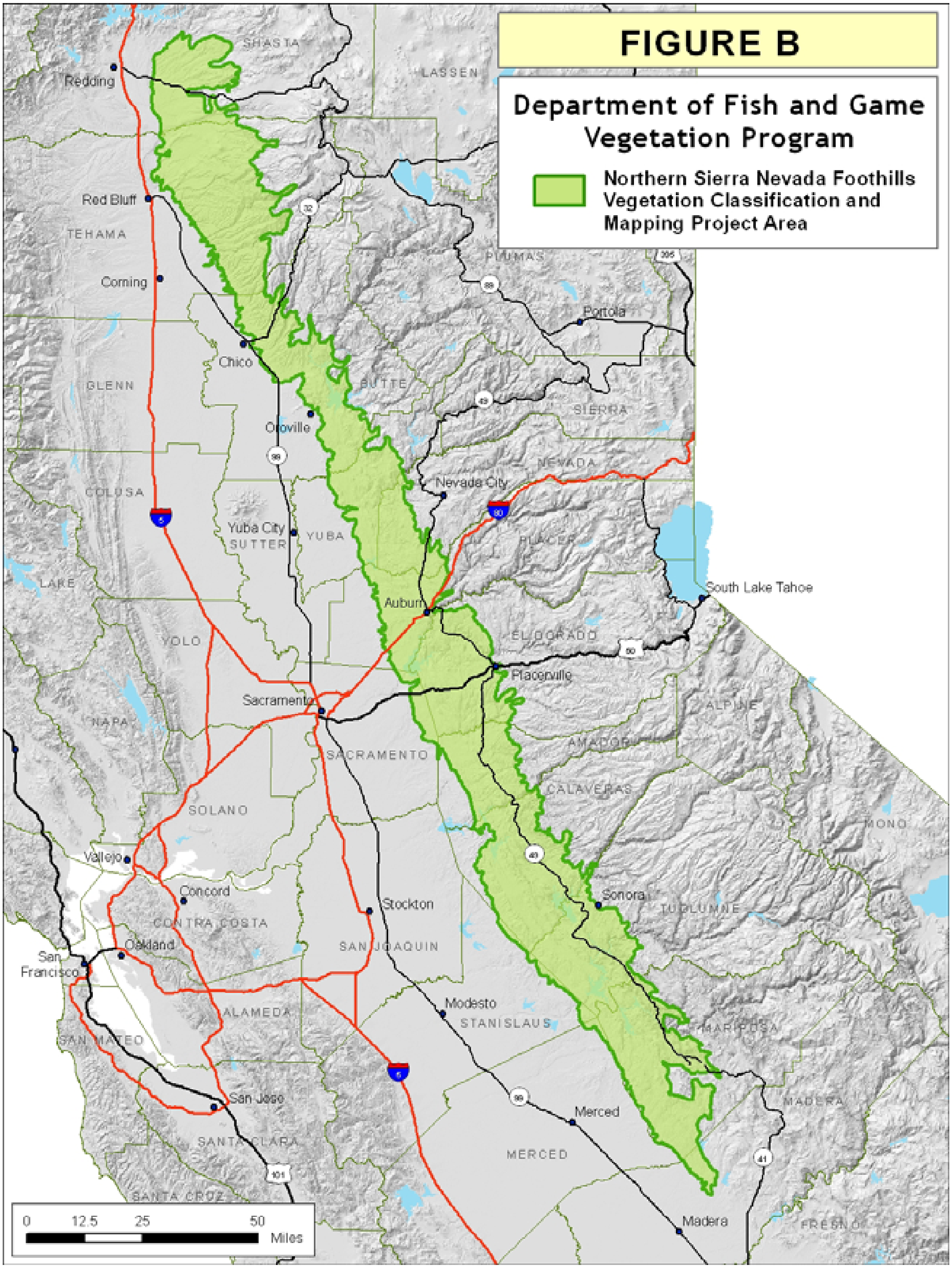
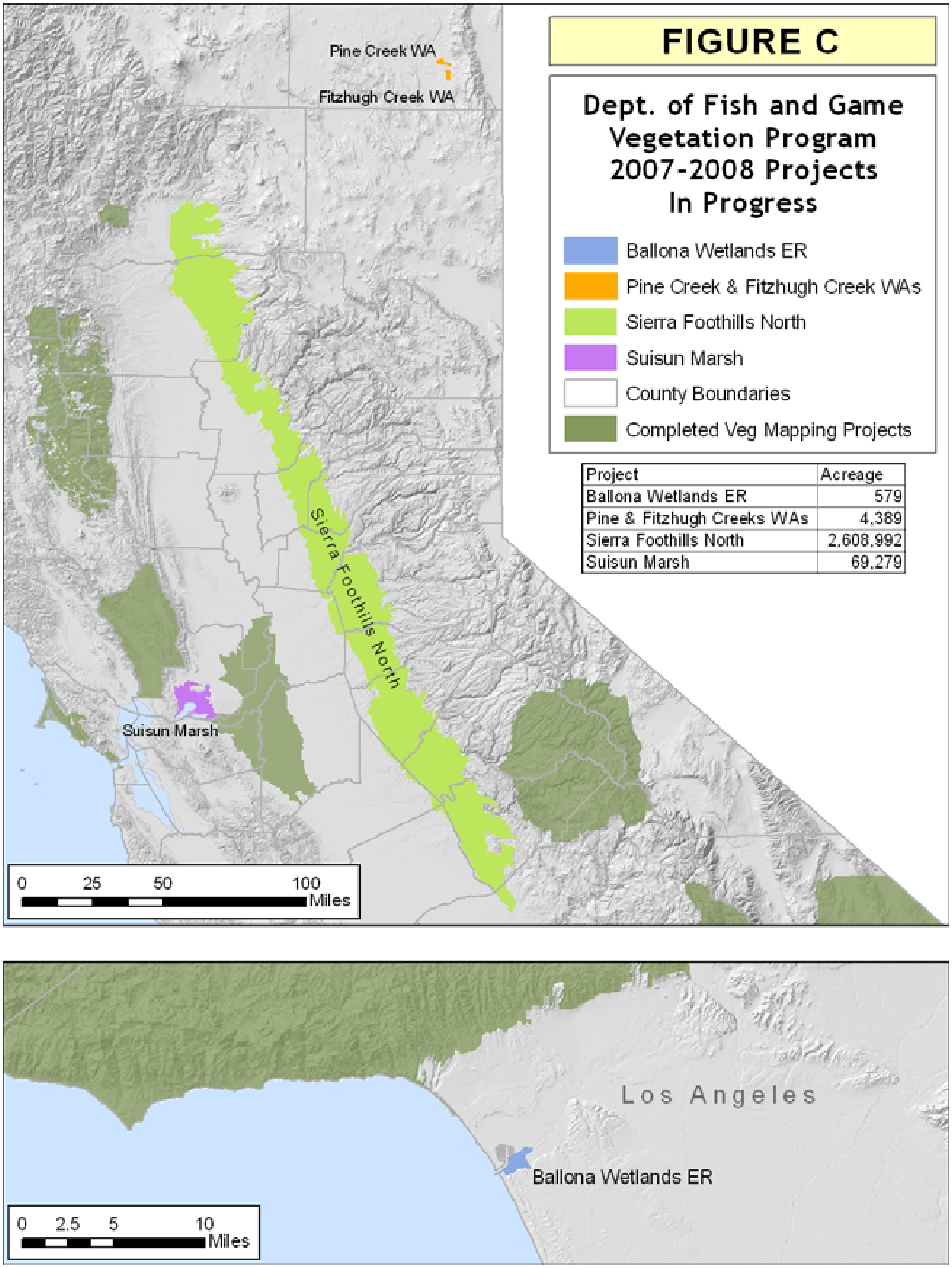


FIGURE B
Department of Fish and Game Vegetation Program
Northern Sierra Nevada Foothills Vegetation Classification and Mapping Project Area
SHASTA
LASSEN
Redding
Red Bluff
TEHAMA
Corning
PLUMAS
Portola
Chico
GLENN
BUTTE
Oroville
SIERRA
NEVADA
Nevada City
COLUSA
Yuba City
SUTTER
YUBA
PLACER
LAKE
South Lake Tahoe
Auburn
YOLO
EL DORADO
Placerville
Sacramento
NAPA
ALPINE
SACRAMENTO
AMADOR
CALAVERAS
SOLANO
MONO
Vallejo
Concord
Stockton
Sonora
TUOLUMNE
CONTRA COSTA
SAN JOAQUIN
Oakland
San Francisco
Modesto
STANISLAUS
ALAMEDA
MARIPOSA
SAN MATEO
San Jose
Merced
MADERA
SANTA CLARA
MERCED
SANTA CRUZ
Madera
FRESNO
0 12.5 25 50 Miles

In addition, the VegCamp Unit is wrapping up the final vegetation classification and maps for the Ballona Wetlands Ecological Reserve and the Pine Creek and Fitzhugh Creek Wildlife Areas, and is helping to coordinate the update to the vegetation classification and map for the Suisun Marsh.

(Figure C – Dept of Fish and Game Vegetation Program 2007-08 Projects in Progress map on next page).



Project	Acreage
Ballona Wetlands ER	579
Pine & Fitzhugh Creeks WAs	4,389
Sierra Foothills North	2,608,992
Suisun Marsh	69,279

b) <u>A map of general geographic areas that the Department and WCB feel are priority locations to conduct vegetation mapping.</u>

WCB and the Department have identified at least six priority areas for future vegetation classification and mapping projects.

(Figure D – High Priority Areas map on next page):

- Southern San Joaquin Valley Counties—approximately 5,320,984 acres
- Southern California Association of Governments Area (SCAG) -- approximately 4,181,971 acres
- San Diego Association of Governments Counties (SANDAG) – approximately 1,008,255 acres
- Southern Hwy 99 Corridor—approximately 2 million acres
- Northern Hwy 99 Corridor—approximately 2.5 million acres
- Association of Bay Area Governments Counties (ABAG) – approximately 3 million acres

Other major infrastructure and NCCP projects such as Tehama-Butte-Yuba Counties, Contra Costa County, SACOG Counties; collectively several million acres.

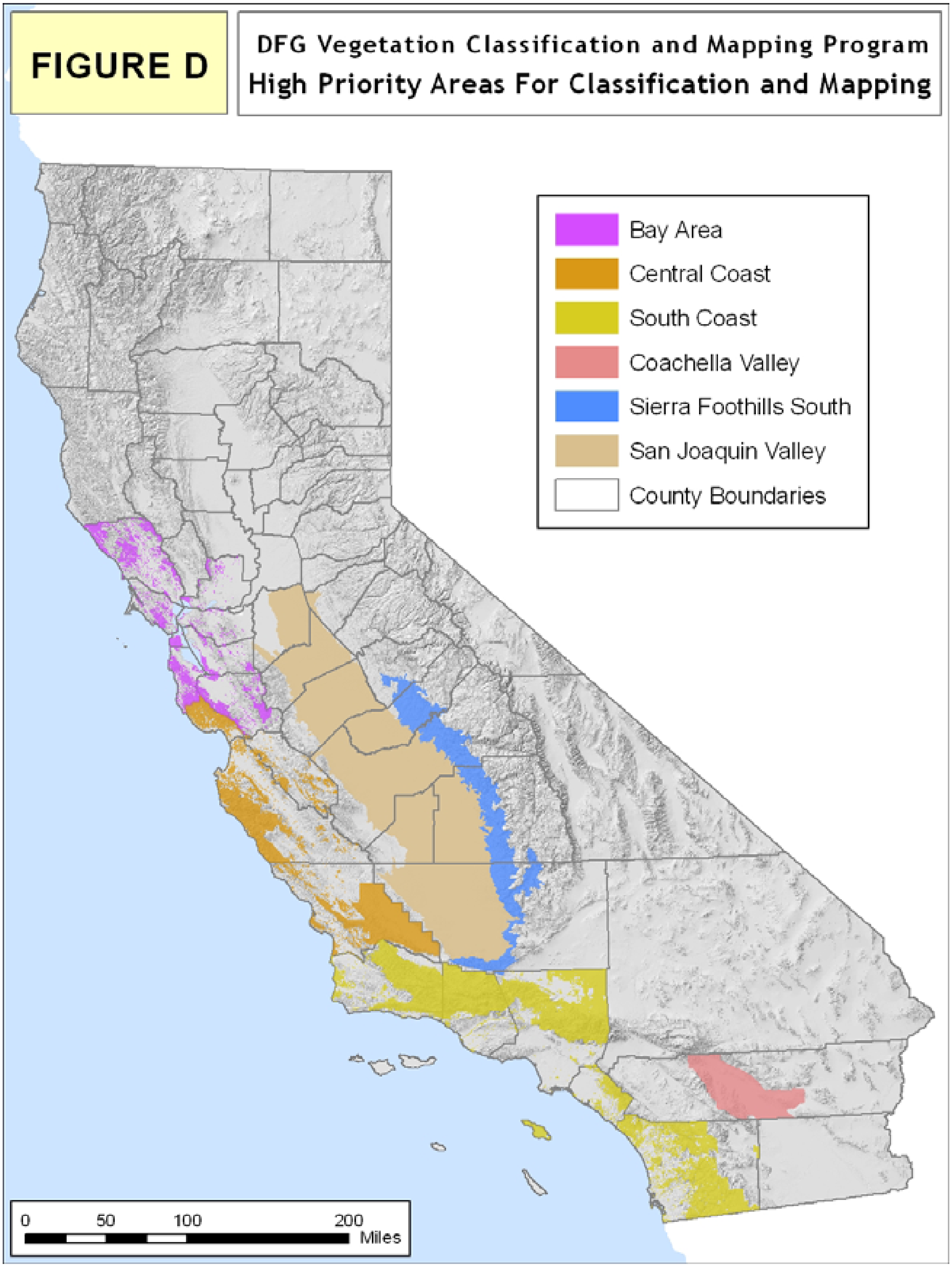


FIGURE D
DFG Vegetation Classification and Mapping Program
High Priority Areas For Classification and Mapping
Bay Area
Central Coast
South Coast
Coachella Valley
Sierra Foothills South
San Joaquin Valley
County Boundaries
0
50
100
200
Miles

c) A map of the known wildlife corridors in the state, based on existing data available to the Department and WCB.

Brief introduction to ecological connectivity and corridors –

The term “wildlife corridors” is often used interchangeably with ecological connectivity. Connectivity, however, is a much broader term that refers to an important function of ecological systems. It is the degree to which the landscape (including waterways) facilitates or impedes the movement of species among preferred habitats (Taylor, et al, 1993). Functional connectivity can exist at a wide range of spatial scales (feet to hundreds of miles) for a variety of purposes (for example, daily foraging, seasonal migrations or expansion to new areas). It is important to recognize that the landscape is perceived differently by different species and functional connectivity for one species (deer or mountain lion, for example) may not work at all for other species (salamanders or plants).

Corridors are simply one way to facilitate connectivity. Connectivity can also be provided in other configurations, such as broad habitat mosaics over large, relatively natural areas or stepping stones of habitat patches (for example, wetlands along waterfowl migration routes) (Bennett 1999, Noss and Daly 2006).

Important wildlife corridors can be defined as crucial habitats that provide connectivity over different time scales (including seasonal or longer) among areas used by animal and plant species (WGA 2007). Most commonly, corridors are identified as relatively linear patches of habitat through which species may be able to move.

Wildlife corridors can exist within unfragmented landscapes or join naturally or artificially fragmented habitats. They may be connections that are not fully and routinely occupied by species of interest but that serve to ensure that such species are able to use disconnected tracts of habitat. They may also be habitat that serves as permanently occupied stepping-stones to facilitate multi-generational movement between larger habitat areas.

Types of approaches used to identify corridors –

Scientists, planners, and conservationists have applied a wide variety of methods to identify and design corridors. The variation in methodology can be traced both to technical issues (e.g., whether geographic information systems and associated modeling tools were available) and to the functions of connectivity of interest in particular cases. Three basic approaches to the design of broad-scale linkages: (1) intuitive or ‘‘seat-of-the-pants’’ approaches; (2) empirical approaches; and (3) modeling approaches, as well as many combined approaches. The following assessment of these approaches is summarized from Noss and Daly 2006.

Intuitive, or opportunistic, approaches are based on subjective best-guesses, existing knowledge, or expert opinion. These may include the shortest, most direct, or most “logical” route between core areas, particularly in landscapes with little natural habitat remaining and where options for connections between core areas are limited; the only remaining routes, such as in highly disturbed landscapes; routes incorporating sites of conservation interest, such as riparian zones; or routes based on expert knowledge of focal species, such as mountain lions or bighorn sheep. These approaches can be useful at times, particularly where there is little data and high uncertainty. For example, the most obvious route to the human eye may also be the most obvious to animals. But in other cases, animals may perceive the landscape very differently, using other sensory inputs such as smell. Expert-based approaches alone can be relatively subjective, lack rigorous scientific methods and documentation and are vulnerable to criticism from scientists as well as from members of the public. These expert-based approaches are best complemented by more rigorous empirical and modeling approaches, using both to inform each other in a step-wise, iterative fashion.

Empirical approaches use field-level data to document actual movement of species through a corridor. These include recording animal presence, movement, or signs based upon direct observation, use of movement-triggered cameras, or tracking; radio telemetry, and marking and recapturing. These approaches provide the most robust, defendable evidence of all approaches described here, but they are the most expensive way to document functional connectivity.

Modeling approaches typically use features of the landscape to identify areas that may be most suitable for movement. They provide a more rigorous, repeatable method for identifying corridors that reflect species needs than expert-based approaches alone. They are best complemented with use of knowledgeable experts and field validation. The usefulness of these models increases as the quality of data improves. Important data sets include natural vegetation and land cover, topography, species ranges and habitat preferences, as well as data that represent movement barriers such as housing and roads. "Least-cost path analysis" is a popular method of using geographic information systems (GIS) to identify corridors. ''Cost'' in this sense is the estimated cost to the animal or population; that is, how much the route might "cost" a species in terms of survivability and risk of danger while moving. It doesn't predict the movement of animals, but rather it predicts the likelihood of surviving the passage from one area to another. The lower the cost, the higher the likelihood is for survival. The results from such modeling will vary depending on which species are targeted because different species have different conservation needs.

Landscape permeability, or habitat integrity, is modification on the least-cost path approach that estimates the relative potential for animal passage across the entire landscape, including the identification of potential barriers to movement. This approach can be useful where core or dispersal habitat for a particular species within a potential linkage is lacking.

A more complex approach is spatially explicit population modeling. This type of approach can be very useful because it explicitly includes the locations of habitat patches, individuals, and other features, allowing scenario testing of the effects of changing landscape structure on population dynamics. They can provide qualitative insights into factors, such as variance in population size, that are difficult to explore using static models. Although more powerful, these models are sensitive to the availability of data on species dispersal factors, which are often poorly known for most species.

Survey methods –

A statewide assessment of wildlife corridors can be conducted in a variety of ways, with the quality of the results varying considerably with the amount of time, funding, and expert involvement. Given the short timeframe for this request, the Department elected to conduct a rapid survey of existing or recent efforts that already have identified wildlife corridors in California. The Department collaborated with the California Department of Transportation in conducting this survey.

This survey focused on terrestrial corridor assessments only, although efforts to identify aquatic connectivity are important also. It targeted those assessments directed at broad spatial scales, larger than thousands of acres. The survey contacted 136 individuals in 6 federal agencies, 9 state agencies, 11 local government agencies, 6 universities, and 15 non-governmental organizations.

Results –

Many different efforts are underway in California to identify wildlife corridors. Due to the time constraints on this report, we were able to obtain GIS data on only six connectivity assessment efforts by November 31, 2007. No single statewide study of connectivity has been conducted and not all parts of California have been studied equally.

Table 1 provides an overview of each of the data sets we identified. Each project is described in terms of the:

- lead researcher or coordinator to contact for more information,
- date of project completion,
- geographic scope,
- focal species or habitats, and
- type of approach used.

The table also indicates the type of data available for each project and the availability of other documentation.

These are only partial results of the survey. The survey will continue for a few more months with existing funding. However, these efforts help exemplify the type of connectivity assessments underway, as well as highlighting the differences in approaches and important gaps in our overall understanding of wildlife connectivity throughout the state.

Table 1. Identified Connectivity Assessment Projects

Project Name	Data Contact; Study Contact	Organization	Project Completion	Geographic Scope (by county or region)	Focal Species or Habitats	Method/ Technique	Areas Connected	Available on BIOS as of Nov 2007	Online Documentation
Central Coast Mountain Lion Connectivity Assessment	Thorne, James	University of California, Davis	2006	Central Coast	Mountain lion	GIS Analysis - Cost surface	Core areas of favorable mountain lion habitat	Yes	http://ice.ucdavis.edu/node/186
Bighorn Sheep	Epps, Clinton	University of California, Berkeley	2004	Mojave Desert	Big Horn Sheep	GIS Analysis - Least cost path	Defined areas of population derived from kernel density of radio telemetry data	Yes	
Coachella Valley Multiple Species Habitat Conservation Plan And Natural Community Conservation Plan	Peihl, Nickolas; Sullivan, Jim	Coachella Valley Association of Governments	Not specified	Riverside	Multiple focal species	Observation/ Analysis	Core Habitat areas defined as areas of unfragmented habitat for each species	No	http://www.cvmshcp.org/Plan_Documents.htm
East Contra Costa County Habitat Conservation Plan and Natural Community Conservation Plan	John Kopchik	East Contra Costa County Habitat Conservation Plan Association	Oct-06	Eastern Contra Costa County	Multiple species and habitats	Observation/ Analysis		No	http://www.co.contra-costa.ca.us/depart/cd/water/HCP/documents.html

Project Name	Data Contact; Study Contact	Organization	Project Completion	Geographic Scope (by county or region)	Focal Species or Habitats	Method/ Technique	Areas Connected	Available on BIOS as of Nov 2007	Online Documentation
Missing Linkages Conference	Penrod, Kristeen	South Coast Wildlands	2001	Statewide	Multiple focal species varying by region and available data	Model: Delphi Approach	Zones of habitat that address needs of multiple focal species	Yes	http://www.calwild.org/resources/pubs/linkages/index.htm
Recovery Plan for Upland Species of the San Joaquin Valley	Kelly, Patrick	Endangered Species Recovery Program	1996-1997	San Joaquin Valley	Proposed areas where connectivity and linkages should be promoted	Expert opinion	Non-native grassland and scrub communities outside areas of irrigated agriculture	Yes	http://esrp.csustan.edu/publications/pubhtml.php?doc=sjvrp&file=cover.html
South Coast Missing Linkages Project	Penrod, Kristeen	South Coast Wildlands	2001-2006	South Coast	Multiple focal species	Observation/ Analysis	Zones of habitat that address needs of multiple focal species	Yes	http://www.scwildlands.org/reports.aspx
UCD San Joaquin Valley Assessment	Huber, Patrick	University of California, Davis	Not specified	San Joaquin Valley	Multiple species and habitats	GIS Analysis	NA	Yes	

Project Name	Data Contact; Study Contact	Organization	Project Completion	Geographic Scope (by county or region)	Focal Species or Habitats	Method/ Technique	Areas Connected	Available on BIOS as of Nov 2007	Online Documentation
Ventura County	Chattin, Elizabeth	Ventura County Resource Management Agency	2004	Ventura	Multiple focal species	Model: Delphi Approach	Zones of habitat that address needs of multiple focal species	Yes	

Following is a brief discussion and map of connectivity assessment projects that exemplify the variety of approaches and results.

- **South Coast Missing Linkages Project (Map 1)**

South Coast Wildlands, a non-profit organization based in southern California, is working to maintain and restore connections between wildlands in the South Coast Ecoregion through an effort called the **South Coast Missing Linkages Project (Map 1)**. During 2002, the organization conducted a series of workshops in southern California, each involving from 90 to 190 participants from 30 to 95 different organizations. Participants identified focal species (plants, inverts, reptiles, amphibians, birds, mammals) representing broad range of connectivity needs.

The organization used existing GIS data to conduct landscape permeability analyses and least-cost path/corridor analysis. For selected species, staff conducted more specific analysis about quality and suitability of habitat patches in potential corridor and visited priority areas to identify and evaluate barriers to movement. Several reports are available online (http://www.scwildlands.org/reports.aspx) with more details of each area.

- **Bighorn Sheep Connectivity Assessment (Map 2)**

Researchers (Dr. Clinton Epps and a team) at the University of California Berkeley collaborated with the California Department of Fish and Game and the University of California's White Mountain Research Station to examine the effects of road barriers on connectivity and genetic diversity of 27 populations of desert bighorn sheep in the Mojave Desert.

This project used a least-cost path modeling approach to identify probable dispersal routes among these populations. Unlike other least-cost path approaches based on habitat preferences and landscape features, this effort incorporated population genetics data that predicted effective gene flow among populations. The GIS model was based on distance between populations and topographic slope. Topography has a strong influence on sheep distribution and habitat use. The researchers compared the modeling results with other movement evidence (direct observation or telemetry), which helped validate the importance of the modeled routes.

Epps et al (2007) describes their approach and results in more detail. This paper emphasizes that these routes represent only one variation on potential routes for sheep movement, acknowledges limitations in their approach, and suggests improvements for future modeling.

- **Central Coast Mountain Lion Connectivity Assessment (Map 3)**

Researchers at the University of California Davis and The Nature Conservancy developed a replicable conservation network design for the Central Coast region of California, intended as the first step in an iterative regional conservation design process

(Thorne, et al. 2006). The project selected the mountain lion as an umbrella species to identify large core areas for conservation.

A least-cost path analysis was used to identify potential habitat linkages between core areas, using factors related to distance, habitat quality, road density, and forest cover. The project then tested the resulting network for its ability to include other biodiversity elements, including five endangered terrestrial vertebrates, serpentine outcrops (as surrogates for rare and endemic plants), The Nature Conservancy portfolio conservation areas, and a variety of vegetation types, including old-growth redwood stands. The network of core areas and linkages represented some habitats (woodlands and forests, serpentine, high-quality steelhead habitat) better than others (grassland). It poorly represented the known distributions of the endangered vertebrates.

Thorne, et al. (2006) describes the strengths of this approach, inherent limitations due to the availability of spatial data, and the differences in conservation challenges for core and habitat linkages.

- **UCD San Joaquin Valley Assessment (Map 4)**

Researchers at the University of California Davis (UCD) provided technical analysis to identify potential conservation opportunity areas for the California Partnership for the San Joaquin Valley. One of the goals of the Partnership's Land Use, Agriculture and Housing Work Group (CPSJV 2006) is to "develop a high value parks and open space strategy to be used in the development of the Blueprint Plan, with a goal of encouraging the creation and long term management (including restoration, as feasible) of a permanent open space system in the San Joaquin Valley". UCD's analysis (Huber 2006) represents one interpretation of biological and natural resource data compiled for the study area. It provides an illustration of one of several potential sets of criteria and weighting systems that could be used to identify constituent biological and natural process elements for purposes of creating a coordinated open space system within the study area.

UCD researchers identified key criteria to identify "hotspots" of conservation priorities, based on workshops with natural resource planners representing federal, state, local, and private agencies and organizations. These included natural communities seldom found on protected lands, riparian areas, wetlands, concentrations of threatened or endangered species, and areas with restoration potential.

They used GIS data to identify important areas and conducted a connectivity analysis to identify potential linkages. This analysis used a GIS tool called the "Universal Model Builder" to identify linkages based on existing vegetation, protected lands, urban areas, and road and waterway density. The researchers acknowledge limitations to this analysis. For example, they recognize that, by selecting different criteria or weighting the criteria in other ways, a different distribution of opportunity polygons and different set of connectivity could have resulted.

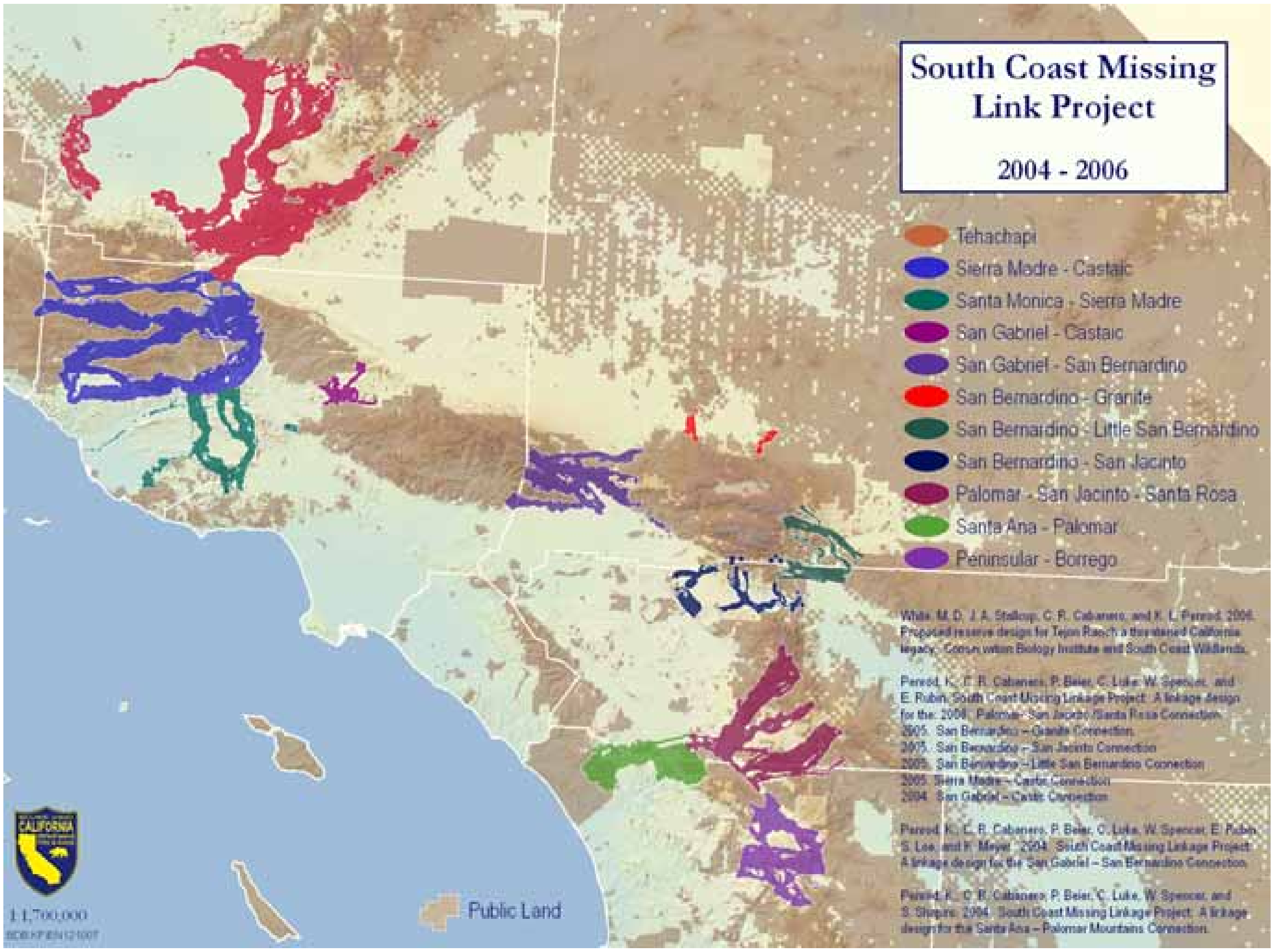
- **San Joaquin Valley Recovery Plan (Map 5)**

The US Fish and Wildlife Service's (USFWS) Recovery Plan for Upland Species of the San Joaquin Valley (USFWS 1998) provides a "step-down narrative" for implementation, with one of the goals to "maintain and establish linkages in existing natural lands and between islands of habitat on the Valley floor and natural lands around the fringe of the Valley". The project used expert delineation of linkages, based on locations of existing non-native grassland and scrub communities on the valley floor as well as physical features.

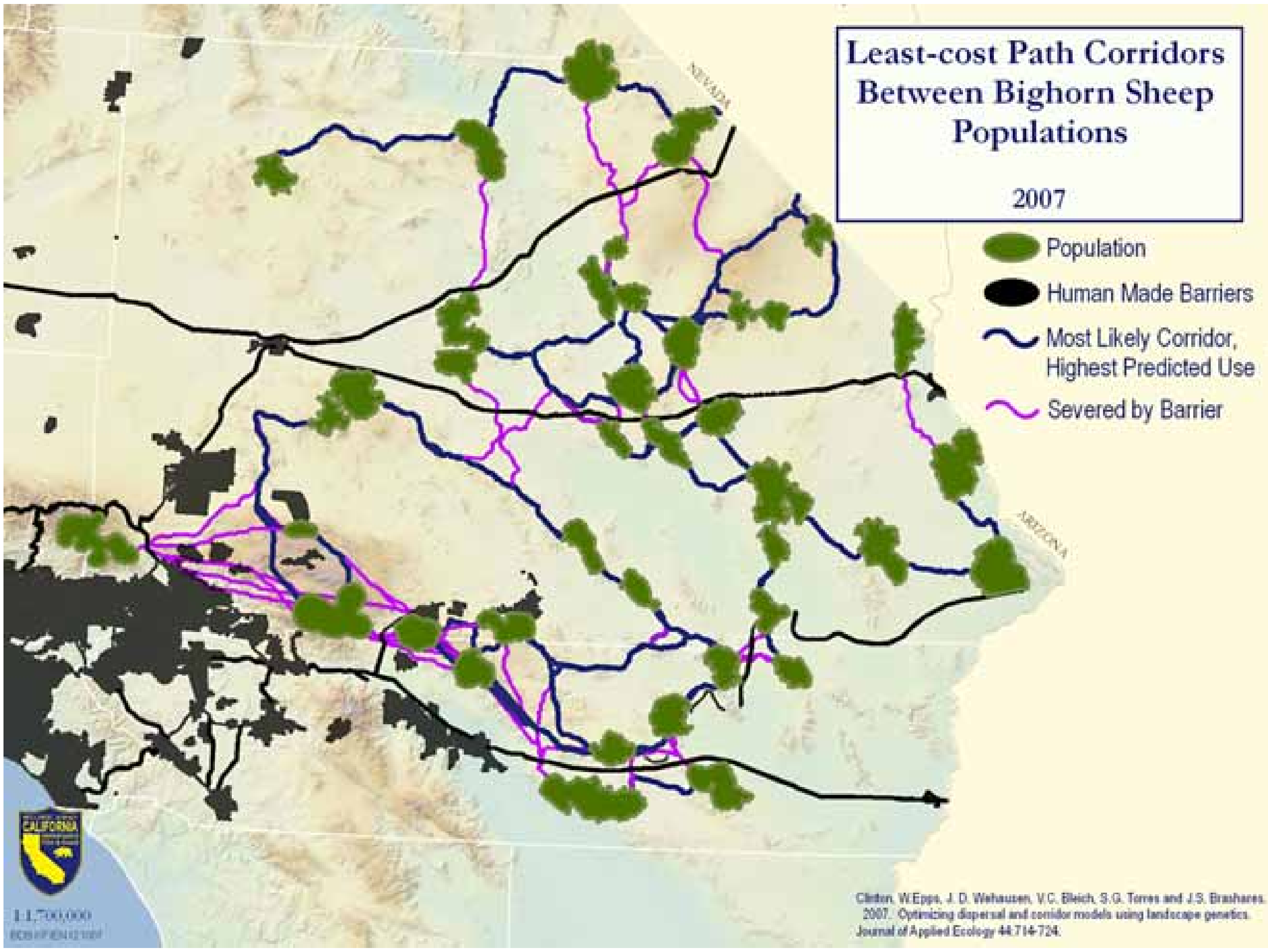
- **Missing Linkages Conference (Map 6)**

In 2000, the California Wilderness Coalition (2001) organized a conference in San Diego to identify potential wildlife linkage zones through California. This conference was sponsored by the California Wilderness Coalition, California State Parks, US Geological Survey, the San Diego Zoo, and The Nature Conservancy. It gathered 160 experts from public agencies, advocacy groups, consulting firms, and academia. The experts identified about 300 wildlife corridors thought to be vital to California's wildlife populations. Linkage priorities were based on the combined knowledge of the experts present and incorporated subjective information on presence of species, threats, opportunities for acquisition and support, and existence of supporting data.

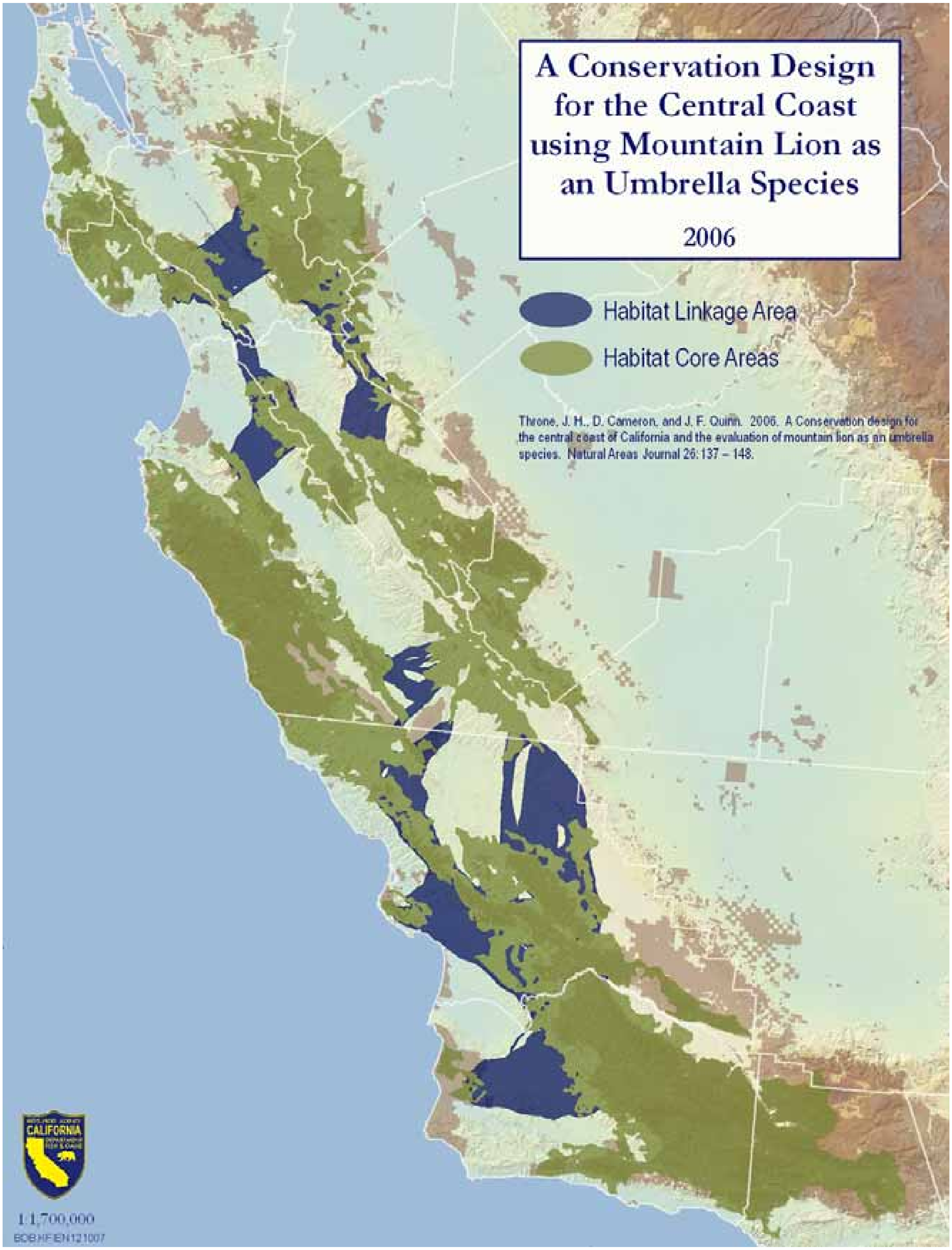
The results from this conference represent a wide mix of the types of approaches listed above. Some of the linkages have been well documented, including the use of field observations. Other linkages are based only on ideas that arose at the meeting by only one or two participants.



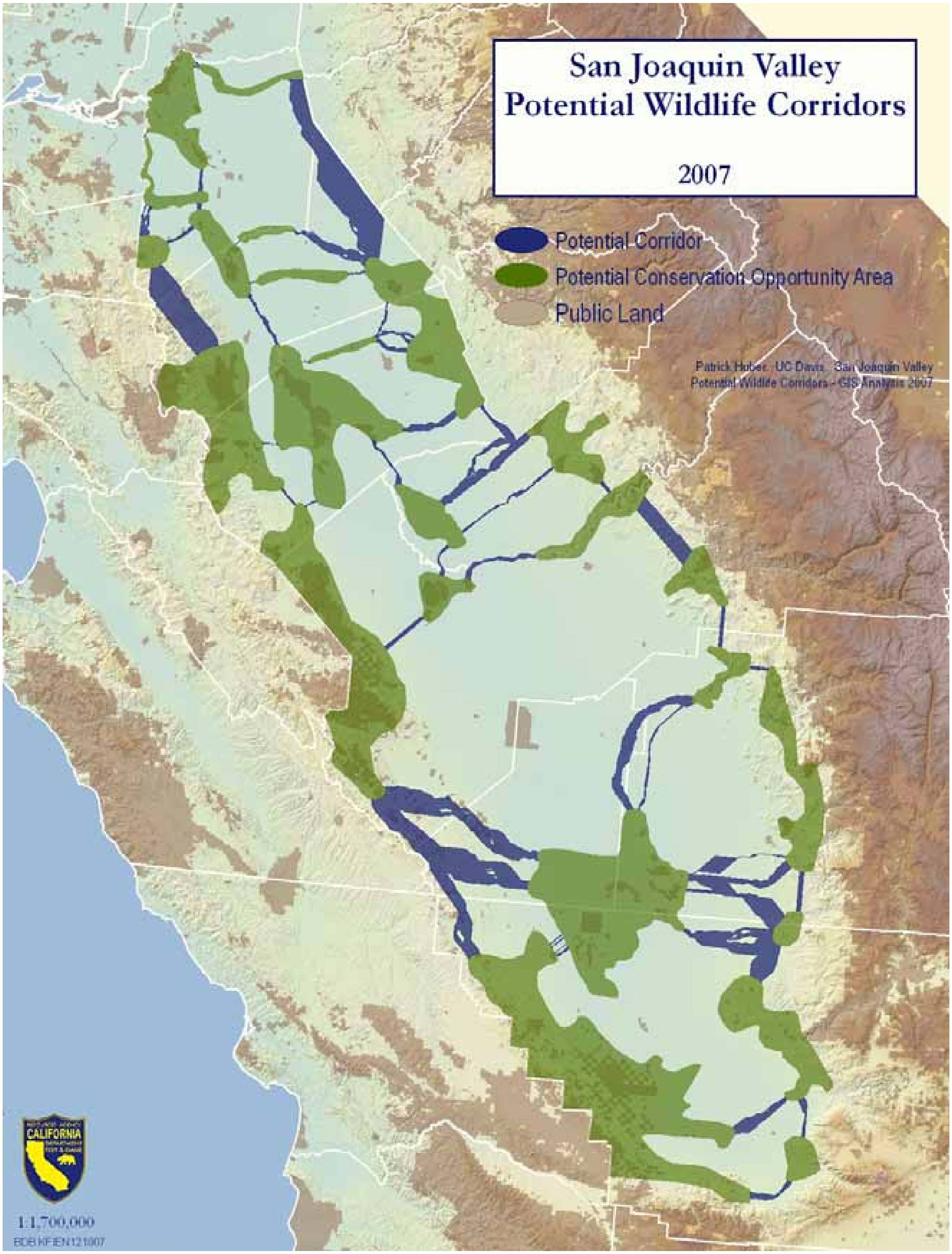
South Coast Missing Linkages Project (Map 1)



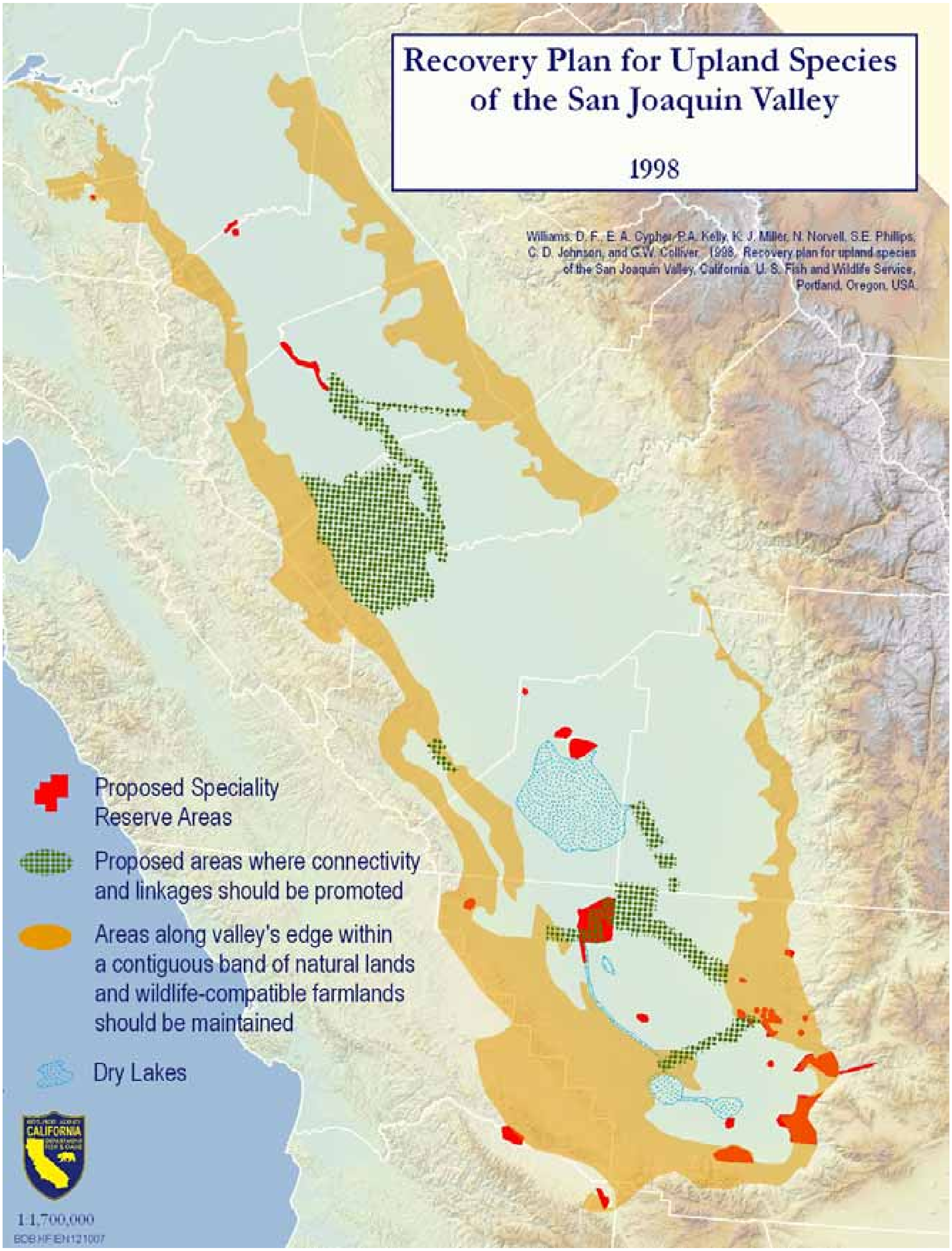
Bighorn Sheep Connectivity Assessment (Map 2)



Central Coast Mountain Lion Connectivity Assessment (Map 3)



UCD San Joaquin Valley Assessment (Map 4)



San Joaquin Valley Recovery Plan (Map 5)

Missing Linkages Conference (Map 6)

General Patterns from Partial Survey

Geographic Scope

Most of the identified connectivity efforts are regional or county in geographic focus. The Missing Linkages Conference data is the only data set that attempts statewide coverage, although it does not represent all potential corridors throughout the state. The **following map (next page)** shows the counties covered by connectivity assessments in the Department's survey. Much of the activity has focused on central and southern California. Broad assessments have been conducted in the Sierra Nevada and the Klamath-Siskiyou area of northwest California, but the Department has been unable to obtain that data in time to include in this report.


Counties Where Corridors Analysis Has Been Conducted
December 2007
Corridor Analyses
Reflects data received by November 30, 2007.
Department of Fish & Game GIS Analysis December 2007.
OREGON
NEVADA
ARIZONA
MEXICO
SIS
MOD
HUM
TRI
SHA
LAS
TEH
PLU
MEN
GLE
BUT
SIE
LAK
COL
SUT
YUB
NEV
PLA
SON
NAP
YOL
SAC
ELD
AMA
SOL
MRN
CAL
TUO
CCA
SJQ
ALA
STA
SCL
MER
SCR
MAD
SBT
FRE
INY
MNT
KNG
TUL
SLO
KRN
SBD
SBA
VEN
LAX
ORA
RIV
SDG
IMP
CALIFORNIA
1:4,660,000
BDB HF IEN121007

Selection of focal species or habitats

Many assessment projects select a set of focal species or habitats for which to design corridors. Others use a landscape permeability approach to assessing the overall landscape, without specific focal species. All of the projects in Table 1 used focal species, but they varied considerably in the number and type of species. The South Coast Wildlands Project used the broadest suite, including 109 species representing aquatic and terrestrial habitats, as well as vertebrates and invertebrates. The UCD Central Coast project and the UCD Central Valley project used a smaller set of three to six species, with a focus on birds and mammals. The San Joaquin Recovery Plan focused on the needs of rare and endangered species. The UCB Bighorn Sheep project had the narrowest focus on only one species.

Type of approach used

Several of the projects listed in Table 1 used modeling approaches, commonly using the least-cost path approach. Several projects also complemented this modeling approach with advice and review by field experts.

Types of areas needing connections

Different projects used different types of areas that needed connectivity. The South Coast Wildlands Project identified corridors between existing public lands. This is useful in a heavily developed area, where most of the remaining natural areas are already on public land. The UCD Central Coast project and the UCD Central Valley project identified corridors between large areas of natural or semi-natural lands, regardless of public lands. The UCB Bighorn Sheep project identified corridors between key population centers of bighorn sheep.

Local expertise

Each of these projects had varying levels of involvement by field experts familiar with either the focal species or the targeted study area. The involvement of other experts is valuable to complement and fill the gaps in existing GIS data sets. Some projects involved a few selected experts to review modeling results. The South Coast Wildlands Project was notable in the level of expert involvement, conducting a series of large workshops to identify focal species and their conservation needs and to review the results of modeling.

Interim Conclusions

Based on the limited number of efforts currently compiled, it is clear that the identification of priority corridors is strongly influenced by the goals of each assessment project. Important areas differ even in the same geographic area, such as the two different efforts in the San Joaquin Valley.

The Department's baseline budget does not support conducting a comprehensive statewide analysis to identify important areas for connectivity in California. The results from such an approach would be more robust and defensible if it includes better quality data, advanced GIS modeling approaches, and the engagement of a wide range of experts knowledgeable in species conservation needs and current scientific thought related to connectivity design. One of the most essential data sets that need improvement is large-scale consistent vegetation mapping. This data needs to be of sufficient quality to model potential habitat and movement barriers for species.

References

Bennett, Andrew F. 1999. Linkages in the Landscape: The Role of Corridors and Connectivity in Wildlife Conservation, International Union for the Conservation of Nature and Natural Resources, Gland, Switzerland. 254 pages.

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